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ADOLF ALT, M. D.

ASSISTANT EDITOR.

W. F. HARDY, M.D.

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THE AMERICAN JOURNAL
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OPHTHALMOLOGY

VOL. XXXIII. SEPTEMBER, 1916. No. 9

ORIGINAL ARTICLES.

TWO CASES OF BACILLUS PYOCYANEUS KERATITIS.

By H. D. Lamb, M.D., and J. G. Calhoun, M.D.,
and additional remarks by Adolf Alt, M.D.,
st. louis, mo.

(The experimental and pathological work was done at the Washington University Laboratory of Ophthalmic Pathology.)

The bacillus pyocyaneus is not always the mild and harmless organism it is generally reputed to be. That certain strains are able to produce the most rapid and extensive destruction of ocular tissues has been observed by numerous writers. Thus Gallenga, Bietti, McNab, de Berardinis, Szczbalski, D. Smith, Sattler, Ewing and Callan have reported cases in which an extensive suppuration of the human cornea was due to this germ. In addition we find this organism responsible for panophthalmitis in the cases observed by Sattler (in two different individuals), by Bietti and Schanz.

Case 1.—Miss B., age 29, employed as a bookkeeper in a shoe store, came to the Mullanphy Eye Clinic, service of Dr. A. Alt, on June 17th, 1916, with a large ulcer on the left cornea.

She stated that on the evening of the 14th (60 hours before presenting herself), after coming home from her work, she had felt some irritation in the eye, and a little later discovered a small white spot on the cornea. She was positive she had had no injury, not even dust in the eye, so far as she was aware, prior to observing this spot. There had been so little pain or discomfort she had not thought it necessary to apply for treatment earlier. She comes now principally because of the spreading of the spot and the consequent great reduction in vision.

Examination showed a grayish semi-translucent ulcer, of cir-

cular outline, occupying the lower three-fifths of the cornea, its surface slightly irregular, and greatest depth somewhat below Bowman's membrane.

A peculiar thing was the almost complete absence of injection, photophobia, or other evidence of irritation, so that it reminded one, in that respect, of keratomalacia. A smear made at this time did not reveal any micro-organism.

On the 18th, the upper margin of the ulcer was only 2 mm. from the upper limbus. Prince's pasteurizer was used and xeroform applied afterwards. A culture was made on Loeffler's blood serum.

19th.—The ulcer has nearly reached the upper limbus. Still there is no pain and but very little injection. The ulcer is deepest above, where it appears as if perforation was imminent.

20th.—Entire cornea involved. Infiltrate not dense; mottled appearance. Iris in places visible. Culture shows a diplococcus. (See pathological report.)

22nd.—Cornea sloughing.

26th.—Iris barely covered with a very thin, mottled semi-translucent layer—probably only Descemet's membrane. Subsequently gradual scar formation; here and there dense bands of connective tissue, with moderate staphyloma upward and temporalward.

Vision: perception of light. (See below.)

On the slant in the Loeffler tube there grew several large orange-yellow colonies which coalesced. A smear made from these colonies two days after the inoculation showed gram-positive diplococci (undoubtedly staphylococcus aureus because of their appearance on the blood serum medium). Five days later a small quantity of the growth was taken from the single large yellowish orange colony in the Loeffler tube and suspended in a few cubic centimetres of normal saline solution. A small amount of this suspension was injected between the layers of both corneæ of one rabbit, and into the anterior chamber of the right eye, into the anterior and posterior chamber of the left eye of a second rabbit.

Two days later the eyelids of the first rabbit were very œdematous on both sides, and on opening them a large amount of yellowish white discharge was seen in the conjunctival sacs. The entire corneæ were densely infiltrated, the surfaces roughened and covered in a large part of their extent by a whitish slough. In the second rabbit the eyelids of both eyes were also

much swollen, the bulbar conjunctiva reddened and œdematous; and the anterior chamber filled with yellowish exudate.

On the third day the discharge was less in the eyes of the first rabbit, but the erosion of the cornea had extended in both eyes over the entire corneal surface. The floors of the ulcers in the two eyes differed quite markedly in their character. While the slough in the right eye was very loose and ragged, involving almost the entire cornea down to Descemet's membrane, in the left eye the destruction of the cornea had not extended so deeply and the floor of the ulcer was compact and comparatively smooth. The smears taken from the corneal slough of both eyes showed Gram-negative bacilli and Gram-positive diplococci. The same material spread over the surface of plain agar gave on the following day flat light-grey colonies behind, and around which the medium was stained a bright green. In addition there were numerous colonies of staphylococcus albus. Inoculation on Loeffler slants gave no color but a gradual liquefaction of the medium after 4 or 5 days. It should also be said that the original Loeffler tube inoculated directly from the patient showed a liquefying of the medium after about one week.

The first rabbit was killed on the third day.

The eyes of the second rabbit on the third day showed little change, but on the fourth day the vitreous chamber of the left eye ruptured. Smears from the contents of the ruptured vitreous body as also from the anterior and posterior chambers of the right eye in this rabbit showed many Gram-negative bacilli in smears, and pyocyaneus colonies on blood-agar slants.

Inoculations with pure cultures of the same strain of pyocyaneus into the centre of the corneæ of other rabbits by means of an ordinary thick straight suture needle gave usually an ulcer spreading in two to three days over much of the corneal surface accompanied by moderate hypopyon.

It is true the original Loeffler tube contained staphylococci to such an extent as to completely obscure in the culture tube the colonies of pyocyaneus. This is easily explained by the fact that the inoculation into the tube was made over a small area and the staphylococci growing more rapidly completely covered the thin pyocyaneus colonies. The bacillus, however, being most hardy and viable was nevertheless growing as demonstrated by its effect in the rabbit eyes.

The injection of staphylococci alone into the rabbit cornea produces a deep, but little-spreading and slowly progressing

erosion, very different from that produced by injection of pyocyaneus alone. It would be interesting to determine whether pyocyaneus from sources other than from infections of human eyes would produce lesions in rabbit eyes. This very naturally brings us to the discussion of how the usually quite innocuous pyocyaneus could become so virulent in the human eye. Might it not be that the bacilli having from contact or from the air gotten into the conjunctival sacs and there incubated and increased greatly in virulence, await only an abrasion or puncturing wound of the cornea to produce such rapidly destructive lesions?

Case 2.—M. B., a colored girl, 11 years of age, came into the Washington University Eye Dispensary suffering in the right eye with a corneal ulcer roughly rectangular in shape, covering about four-fifths of the corneal surface. Its depth was apparently about one-fourth the thickness of the cornea and rather uniformly deep over the entire affected area. The floor of the ulcer was much roughened, devoid of all slough, and in fact quite transparent. There was a moderate amount of yellowish-white very stringy discharge. Temporally to and below the ulcer there was seen in the cornea a rather dense yellowish infiltration while the other parts of unulcerated cornea were hazy and infiltrated to a much greater extent than the floor of the ulcer. A hypopyon about 1½ mm. in height was noted.

The resemblance of this ulcer to that of the above case, in the large extent of surface involved, the cleanliness and clearness of its base, made one think that the same organism might be the exciting factor. This supposition was strengthened by the history of its very rapid progress. The mother stated that 5 days previous, while splitting kindling, the child was struck in the right eye by a flying splinter. She did not complain of pain that day nor did the eye look red. The following day, however, the pain was marked, the eyeball was reddened and ran water. The evening of this day a family physician was consulted, who prescribed drops which were used during the next day. On this, the third day, the mother stated there was much discharge. In the morning of the following day a specialist was consulted, who found the ulcer had spread to the extent seen at the clinic two days later. The oculist stated that there was an hypopyon 1½ mm. high, no slough over the ulcer and but little discharge. Smears from scrapings of the floor of the ulcer showed diplococci. The edge of the ulcer was cauterized. The next day a greenish discharge was present in large amount and it was

thought that pyocyaneus had come in by chance from the air as it does occasionally in abscess cavities. The following day, the fifth one since the injury, was the first one at the dispensary.

From the appearance and history of the affection as given by the mother (that from the specialist was obtained later), therefore, it was tentatively diagnosed as a pyocyaneus ulcer. Cultures on this first day at the dispensary were taken on Loeffler blood serum and plain agar slants. The following day the agar tubes showed the characteristic pyocyaneus colonies. The Loeffler tubes showed many white colonies, some quite small, which on culturing further were proved to be of the staphylococcus albus. Argyrol 25 per cent. was prescribed to be used three times a day at home, and at the clinic irrigations with boric acid, xeroform in castor oil, atropin 1 gr. to 2 drams were used daily.

On the third day at the dispensary the eye showed a marked improvement, the infiltration on the temporal side greatly diminished in width, the base of the ulcer was more transparent and the hypopyon about one-half its former height. The improvement continued steadily until in about one week after entering the clinic the purulent infiltration in the cornea about the ulcer and the hypopyon had disappeared, and the base of the ulcer was still quite clear. In five more days the floor of the ulcer was seen to be turning gray, as slowly and gradually began the filling in with new fibrous tissue. No discharge at all appeared to be present after the first 3 or 4 days, and cultures after one week showed no pyocyaneus organisms.

At the present date, six weeks since the accident to the eye, the cornea is still flattened but rapidly regaining its normal convexity. A rather dense dark-grey mass of new fibrous tissue occupies the original roughly quadrilateral ulcerated area, leaving above and below about 3 mm. and to the outer and inner side about 1 mm. of untouched corneal tissue. This scar formation is rather mottled in color; in the centre of the cornea, it is somewhat more transparent. The outlines of the pupil can be seen by oblique illumination, and vision is reduced to counting fingers at 18 inches.

In this case, also, diplococci figured and the specialist first consulted considers the destruction to be due to pneumococci. But pneumococci do not produce such ulcers as in the above cases, whereas the bacillus pyocyaneus has produced similar rapid destruction of human corneas in the cases above referred to in the literature, to say nothing of the easy demonstration of its power in rabbits' eyes.

It would seem that ulcers caused by the pyocyaneus have a distinct pathology of their own. Typical corneal infections by this organism when once observed and identified are easily recognized when met again. They are distinguished most certainly by their very rapid and extensive progress over the surface and into the substantia propria of the cornea, three to seven days sufficing for this bacillus to destroy corneal tissue over its almost entire extent, and in depth from one-quarter of the corneal thickness to Descemet's membrane. The suppurative process is apparently self-terminating, being unaffected by the ordinary measure for corneal ulcer. At the termination of the tissue destruction the slough is entirely thrown off and the clean transparent floor of the ulcer appears in strange contrast to the surrounding hazy infiltrated margins.

The extra-cellular toxin produced by the pyocyaneus is said to contain a trypsin-like ferment which would explain its amazing power of destroying corneal tissue.

Its poison being extracellular suggests the possibility of obtaining an antitoxin by injection of the bacillus into animals just as in the case of diphtheria and tetanus. Fortunately these ulcers are too rare to warrant the formation and keep on hand of stock preparations of pyocyaneus antitoxin.

ADDITIONAL REMARKS.

By Adolf Alt, M.D.

On September 24th I had again occasion to see Miss B. (Case 1) at my office. There was some ptosis of the upper lid, which was explained by the flatness of the cornea, which was now not only free from staphylomatous protrusions, but actually almost perfectly flat. On inquiry I found that early in August, while wiping her face with a towel, she had a sudden pain in this eye followed by a great deal of watering. Evidently a rupture of the staphylomatous portion had occurred. Strange to say, the newly formed corneal tissue was fairly clear except one band of grey blue scar tissue in its lower third. The desire to have this removed brought her to me. Through this almost clear tissue the iris and irregular but large pupil lying close to the posterior corneal surface could without artificial light be easily seen. No appreciable ophthalmoscopic reflex was seen and yet the patient counted fingers at 7 feet. The field for light was somewhat contracted.

CONCERNING THE TREATMENT OF TABETIC OPTIC NERVE ATROPHY.

(From Prof. Dr. L. Heine's Eye Clinic, Kiel.)

By Dr. C. Behr.

(*Concluded from August Number.*)

Yet, it would be unjustifiable to start an energetic antiluetic cure without sifting in every case of tabes. There are still two opinions on this point. Some authors, like Bing in his textbook on nervous diseases, think any treatment of tabes contraindicated when the optic nerve takes part in it, since through it the optic nerve affection can be rapidly made worse.

Others, like Uhthoff, deny such a connection and explain the acute deterioration as an accidental appearance which would have come on, also, without therapy. I do not think this assumption is unjustified, since in fact in many cases of optic nerve atrophy suddenly a rapid destruction of function takes place which leads to amaurosis in a short time. Still, such cases are rare.

Last year Vossius, based on some cases in which he saw amaurosis develop rapidly after therapy, has warned against salvarsan. Schnaudigel and Bennario could not accept this view; on the contrary in several cases they had seen extraordinary improvement from treatment with salvarsan.

I have seen in the last few years 4 cases in which immediately after specific treatment a very great deterioration appeared, which in a short time produced blindness in both eyes. Had there been one case only I should have inclined to assume with Uhthoff an accidental occurrence. The multiplication of cases, however, produces the impression that the treatment caused the deterioration. In favor of this there is the fact that the loss of function was bilateral and of the same degree. There are, therefore, certain cases of tabetic atrophy which are made worse by treatment. The question now is whether these cases have certain peculiarities which characterize their course and their clinical picture and whether through these we can distinguish them from the numerous other cases which behave indifferent to any therapy. A short description of my cases together with the opinions to be found in literature will best be able to give some directions as to our therapy.

Case I.—C. S., 43 years old. May 26th, 1910. Infection unknown. For one-half year saw floccules. Since then, as Wassermann was positive, mercury cure and calomel injections. V.=R. 6/5, L. 6/20. Pupils react promptly. Concentrical contraction of both visual fields, especially up and down. L. more so than R. Color sense good. Limits relatively large. R. optic papilla temporally white, nasally slightly red. L. optic papilla in toto intensely white. Diagnosis: tabes dorsalis in existence for 5 years. Salvarsan cure by family physician. July 2nd, 1910. Entered clinic. V. R.=6/7, L. light perception. R. field a small central remnant with preservation of color perception. No orientation in space possible. In spite of calomel cure, Zittmann cure, salvarsan injections, the decrease in visual acuity and the contraction of the field augment. August 7th, light perception R. Soon after discharge complete amaurosis.

Case II.—M. H., 42 years old. Infected 20 years ago. Not treated. Sees everything smaller the last three months. August 28th, R. V.=5/15. Atrophy of both optic nerves. Papillæ white. Sector defect in both fields. Serum positive September 17th, salvarsan followed. September 16th, by great contraction of fields and loss of vision, R.=5/15, L.=5/50. October 7th, V. R.= 5/15, L.=1/50. Fields still smaller. Dark adaptation gone. Asurol. October 13th, R.=6/50, L. movements. October 20th, fingers at ½ to 1 mm. Soon after discharge amaurosis. (In 33 days from 5/5 and 5/15 to amaurosis.)

Case III.—K. N., 41 years old. Infected 20 years ago, never treated. Light in reading diminished. Presbyopia. Of late rapid loss of vision in R.E. with seeing of sparks and fire red floccules. October 15th, 1912, V. R=6/18, L.=6/18. Miosis. R. total atrophy, L. temporally atrophic. Medium contraction of field. Color limits almost joining those of white. Dark adaptation 45 minutes, R. 321, L. 321 E.E. Tabes dorsalis. Inunctions; calomel, asurol. November 21st, 6/60 both. Only a central remnant of fields with color perception. December 9th, R. fingers before the eye, L. fingers at 1.5 mm. Zittmann cure. January 6th, dark adaptation: 46, 51 EE. Four weeks later light perception only.

Case IV.—W. H., 30 years old. Infected 10 years ago. Then inunction cure for 8 weeks in spite of papules at anus, therefore another 8 weeks of inunctions. Then pot. iod. Not treated till 1904. Then sudden paralysis of left sphincter pupillæ which was cured by mercury pills and pot. iod. 1906, relapse with paralysis of accommodation. Inunction for 7 weeks. Cure. 1908, re-

lapse, inunctions for 6 weeks. Now (1910), has been under treatment for some months. Inunctions. In spite of it decrease of formerly excellent vision for far and near.

Since May, 1910, sudden great diminution of vision in left and later in right eye, too. This happened within two days. It remained unchanged for two weeks and now for a week a further rapid diminution has been noted. A week ago he still could read large type. Phosphenes accompanied this. June 15th, 1910, R. 6/50, L. amaurosis. Ophthalmoplegia interna, both. Both papillæ pale in toto; R. less than L. R. nasal remnant of field, vertical line of separation goes through point of fixation. Outlines for blue and red are large. Wassermann in blood positive, in liquor negative, lymphocytosis, increased albumens. In spite of Zittmann, calomel injections, salvarsan, only fingers in front of the eye two weeks later. Discharged. Soon after complete amaurosis. This developed from normal function in two months.

If in this case and case II. I feel justified in assuming a tabes dorsalis, based on the eye symptoms and the Wassermann reaction without any general findings, and in excluding pseudotabes luetica, I base this on the authority of Uhthoff, who in his large experience and exact knowledge of the literature, denies the occurrence of a bilateral amaurosis on the sole basis of cerebrospinal lues.

These 4 cases have in common that at the beginning of the treatment the visual functions were still relatively normal and that in the short time of from 1 to 3 months almost total blindness came on. If we neglect the last case, which came under observation when there was already a considerable deterioration of the central vision and in which from the patient's statements the degree of vision can be only approximately judged, there was in one case V.=6/5 and 6/20; in the second one 5/5 and 5/15, and in the third 6/18 in both eyes. The visual fields were more or less concentrically contracted, the color outlines were relatively less contracted than those for white so that they often lay close together or joined each other. In all the optic nerve was white usually uniformly over the whole transverse section of the papilla. The rapid deterioration of vision came on in all cases immediately after the beginning of the treatment. There was no difference as regards the remedies used. Unguentum cinereum, calomel, asurol, salvarsan, had the same bad effect. An energetic continuation of the treatment not only brought no standstill, but contributed to the rapidity of the loss of function. Meanwhile there were no alarming symptoms on the part of the

general nervous system. If there were any they remained uninfluenced by the therapy. The infection was not of a specially malignant character.

This is apt to prove that not the infection, but the special manner of localization and distribution of the germs and the peculiar anatomical conditions of the optic nerve are the cause of the rapid deterioration. The clinical picture of optic nerve disease does not, I think, give us a sufficient explanation. It is astonishing that in all the four cases in the beginning the atrophic discoloration of the papilla was much more pronounced than considering the small functional disturbance one should have expected. Although in optic atrophy we can in general not judge the degree of functional disturbance from the degree of atrophic discoloration of the papilla, tabes in this point is an exception. The atrophic discoloration is primarily due to the wandering down into the papillæ of a simple degeneration, not as, for instance, in neuritic atrophy also to a connective tissue and glia proliferation. Although in tabes the objective changes of the papilla always precede the subjective disturbances, the degree of functional disturbance depends alone on the number of degenerated fibres; the more numerous these are, the more the atrophic discoloration progresses to a pronounced and diffuse atrophy. A certain parallelismus between the severity of the atrophy and the degree of functional disturbance therefore usually exists in the beginning (Uhthoff). The atrophy which was in the beginning of our cases pronounced and uniform, points to it that the primary focus was of great extent and did not limit itself as usual in beginning of cases to a few peripheral bundles. That the subjective symptoms of this were comparatively unimportant is explained by the elective character of the specifically tabetic tissue destruction. In every nerve fibre bundle there are aside from the numerous destroyed ones a sufficient number of normal ones preserved which suffice to cover up the loss to our gross methods of examination (field and color sense). Only the diminution of the dark adaptation, as described, uncovers this damage.

The observation, that in all the four cases the beginning of the optic nerve disease was marked by severe subjective phosphenes, seems to me to be of especial importance. Usually the development of the disease is so gradual that the patient notices it after a long time only. This usually takes place "with the symptoms of slowly increasing paleness and indistinctness of the objects" (Uhthoff). The most frequent accompanying symptom is the perception of a mist, while according to Wilbrand and Saenger

more severe subjective complaints (phosphenes, sparks, etc.) are rare. Such symptoms cannot be explained simply through the degenerative process, they rather speak for simultaneous irritative conditions in the nerve.

Since according to recent observations (Hess) purely mechanical insults to the optic nerve are not able to produce light phænomena, the cause in our cases can lie only in chemical irritation of the nerve fibres produced by the toxins of the spirochaetæ. These symptoms, too, point to a great concentration of the spirochaetæ in the tissue and, also, to a special activity of the local specific process.

How, under these conditions, diffuse distribution and great activity of the tabetic process, does the therapy produce a rapid destruction of the visual function? It is known that a spirochaetæ focus answers the treatment with a reaction which is the stronger the smaller the killing effect of the agent, that is, the less concentrated it is. Above I have explained why in the central nervous system, especially in the optic nerve, the anatomico-physiological conditions are relatively bad for a medicamentous attack on a spirochaetæ focus. I have shown that even with a sufficient general concentration of the remedy, in spite of the killing of the spirochaetæ in some places, in others an irritation takes place which shows itself not only in a proliferation of the micro-organisms, but, also, in the reaction of the infected tissue (provocatory salvarsan injection). If the nerve is diffusely permeated by the spirochaetæ—as we must assume in our four cases—the worst possible conditions for treatment exist; the irritating, rather enriching, effect will overshadow the killing one. Then the unavoidable, strong tissue reaction leads, on account of the peculiar anatomical structure of the optic nerve, to further serious damage. The tense unyielding pia mater sheath during an increase in volume due to inflammatory œdema prevents an equalizing enlargement of the transverse section of the nerve. In consequence of this, if an inflammatory reaction occurs suddenly, a corresponding increase of internal tissue pressure must result. After a certain degree of this has been reached the nerve fibres are necessarily damaged, not only by the pressure but, also, indirectly through the obstacle to nutrition in consequence of the compression of the afferent bloodvessels. Fibres damaged in this way are, of course, less resistant toward the spirochaetæ toxins in the tissue fluids. The vicious circle is closed.

An analogon to this explanation is furnished by the acute retrobulbar neuritis in multiple sclerosis and other affections. There is often in the beginning amaurosis and immobility of the pupil with at first normal ophthalmoscopical conditions. Soon the visual field returns, except an absolute central scotoma. The latter is a focal symptom, the loss of the peripheral field is an accompanying symptom. The focus appears at some place of the optic nerve in the central bundle and interrupts its fibres. Through the severe inflammatory conditions in the focus (serous imbibition, hyperæmia, small cell infiltration) the internal pressure in the nerve rises so high that the conduction is mechanically interrupted, also, in the peripheral fibres. When it recedes and when the internal pressure becomes normal again, the conductivity of the peripheral fibres also returns. In comparison with these conditions, the reaction of the tabetic process to the therapy is less intensive and acute, but it lasts longer. Moreover, it seems that in multiple sclerosis the micro-organisms are lacking outside of the focus so that a further damage of the fibres affected by the pressure through the infection does not take place.

In this manner we can explain why in the reported cases such a serious increase in the functional disturbances occurred. It is less a special malignancy of the infection carriers than their diffuse distribution in the nerve which shows itself clinically by the appearance of stronger subjective signs of irritation and through the disproportion between the high grade optic nerve atrophy and relatively insignificant functional disturbances.

Of all the authors who warned against the treatment of tabetic optic nerve atrophy, Wilbrand alone did not in principle speak against every treatment, but tried to find the danger limits. According to him danger through the therapy threatens especially in those cases in which with relatively normal outlines for white there is at an early stage a deterioration in the color fields and a diminished central acuity of vision. This symptom complex, also, points to a diffuse participation of the transverse section of the nerve in the disease process. Recently, in his neurology, he mentioned a second group in which with an extensive contraction of the field for white there is a good color sense (joining of the outlines) and normal vision. Into this group we might perhaps place our Case I.

There are thus three types of tabetic optic nerve atrophy in which an antisyphilitic therapy is contraindicated.

1. Diminution of central visual acuity, early loss of color sense with normal or nearly normal outlines for white.

2. High grade concentric contraction of the visual field, the outlines for white the same as for colors, normal or nearly normal visual acuity.

3. Insignificant field disturbances which concern white more than colors (here, too, joining of their outlines), normal or nearly normal visual acuity with ophthalmoscopically well pronounced atrophy. Strong subjective phosphenes.

In these cases it seems best to wait and to incite the metabolism by higher doses of iodides. Although by such an expectant therapy we cannot pervent the coming on of the amaurosis, but only retard it, we serve the highest principle in our art: *Nil nocere.* Furthermore, with the tendency of tabes to remissions, we may, too, hope for a standstill for some time in the optic nerve process, in which the activity of the process diminishes and thereby the conditions are rendered more favorable for our therapy.

In all other cases a specific treatment of the optic nerve process is not only not permitted, but as the cases in the first part of this paper show, highly indicated and as energetically and for as long a time as possible.

Finally, I should like to say a few words about a new experiment in the treatment of tabes which seems to have been successful in some cases. The experiments are not yet concluded, still I like to mention them in short, since my discussions at the beginning of this paper are the theoretical premisses of this new trial. We know that the cerebrospinal fluid comes in the main from the brain and spinal chord substance; that, therefore, in a certain sense it is a product of metabolism in the central nervous system. The parenchymatous stream comes out of the blood-vessels, by means of the glia fibre system it reaches the working ganglion cells and nerve fibres and then by means of glia fibres it comes out of the brain into the ventricles, the subarachnoidal and perivascular spaces. If through a lumbar puncture a larger amount of cerebrospinal fluid has been removed, the secretion of the fluid in the tissue is incited thereby, the more so since from the puncture opening in the dura a slow fistulization usually takes place into the epidural tissue. If at the same time a specific agent has been introduced into the body on account of the increased metabolism a greater quantity of this must enter the cerebrospinal tissues by means of which the physiological ob-

stacles to reaching the therapeutic dosis in the nervous tissue are probably considerably reduced.

In my cases I have for months removed weekly once or twice about 10 cm. of cerebrospinal fluid during an energetic specific treatment. No damage resulted. The results seem to be so encouraging that I shall again take up this method on a larger scale after the war and even now think I am right in recommending it.

One word about the endolumbal therapy of tabes which seems to have spread considerably of late. Since the cerebrospinal fluid is secreted from the central nervous system, it is very improbable that it will reversely return to the nervous tissue from the lumbal sac. There are, therefore, no theoretical grounds for the success of the method of endolumbal injection. It is *a priori* improbable that the salvarsan solution injected into the lumbar sac can be carried directly to the several disease foci. That in spite of this an improvement has been obtained in some cases is explained by the not at all rare combination with meningeal syphilitic processes against which this treatment must have an especial effect.

SULPHUR REHABILITATED IN SYPHILIS AS A VALUABLE AID TO ARSENIC, MERCURY AND IODIDES. METHOD OF ITS EMPLOYMENT.*

By D. A. Darier.

Empiric therapy has always given to mercury the first place in the treatment of syphilis; but it did not ignore the active force of arsenic and sulphur, not to speak of iodides which have come much later.

The important position which arsenic has taken in these latter years is well known ever since the important researches of A. Gautier concerning the cacodylates, of Ehrlich with atoxyl, arsacetin and salvarsan, finally those of Mouneyrat as regards hectin and galyl.

According to McDonagh salvarsan does not act directly on the spirochaetæ but by increasing the amount of active oxygen in the serum of the patient. In fact, all the metals introduced into the organism in a trivalent form have the same oxydo-reducing power. This author recommends therefore compositions of iron and aluminium devoid of all toxicity in preference to the very toxic compositions of arsenic. He states that he produced the same results with ferrivine (triparaaminobenzineferrisulphonate), as with salvarsan, galyl, etc.

To-day it is sulphur which has recovered its honorable position in the form of diorthoaminothiobenzene or intramine, since every new synthetic composition must, to respect itself, be baptized by a small name, easy to remember. This is a yellowish amorphous powder with a greenish tint which possesses the immense advantage of not being toxic in any dose, contrary to all arsenious compositions. The usual dose for an adult ought to be one gramme in nine cc. of olive oil or paraffin injected intramuscularily.

Intramine does not alter in the air and its oily suspensions can be kept like the mercurial oils.

Comparing the action of intramine with that of salvarsan McDonagh has observed that during the primary period of generalization salvarsan has a more pronounced action, while in the second and tertiary stages intramine takes the lead. Moreover, the previous use of metallic compositions enhanced the

*La Clinique Ophtalmologique, May, 1916.

action of intramine in the initial period, and on the other hand in the late forms of syphilis intramine increased the action of the metallic compositions, as salvarsan, galyl, etc.

When intramine is given at the very beginning of syphilis the spirochaetæ are not killed, and if salvarsan is then injected one is astonished at its weak action; if on the contrary salvarsan is injected first and intramine afterwards the effect is most pronounced.

In a case of indurated chancre, after an intravenous injection of 0.40 galyl and three days later an intramuscular injection of 3 grammes of intramine had been made, the chancre and the induration had altogether disappeared a few days later.

The writer has seen papular syphilides which had hardly been influenced by galyl alone heal in a few days after an injection of intramine.

In a case of greatly indurated chancre of the glans with very marked œdema of the whole penis and general eruption of palpular syphilides, three injections of galyl having been without result and the eruption even increasing, every trace of syphilis disappeared in ten days after one injection of intramine.

In late syphilis exactly the reverse has taken place.

A patient had a large gummatous ulcer of the glans, the penis and the scrotum; in less than one week after one injection of 2 grammes of intramine the ulceration was perfectly cicatrized.

Lesions which had remained refractory to salvarsan, mercury and iodide have in late syphilis yielded true success to intramine.

A man, 70 years old, who for 25 years had a severe syphilitic glossitis, had been given salvarsan, then mercury and iodides for 18 months without any visible improvement. After one injection of 2 grammes of intramine the ulcer was perfectly cicatrized in the period of a few weeks, and the tongue had resumed its motility and suppleness so completely, that the patient stated he could not remember the time when his tongue had been so well.

In late syphilis, therefore, intramine should be at once employed. In meningo-spinal syphilis the pains disappear in 24 hours. In degenerative myelitis (sic) the subjective symptoms are often improved. The same is the case with certain cases of encephalitis.

A patient was attacked by an encephalitis of the depressive

type, the face without expression, absolute mutism, etc. Two injections of intramine brought back some expression to the face and after several days the patient could keep up a conversation. A third injection having been followed by a marked aggravation one injection of galyl was given which in 48 hours gave the patient the appearance of a healthy and reasonable man.—How long will this last?

This is a confirmation of the fact that in late syphilis an injection of a metallic salt (galyl) increases the action of intramine, while in the primary period intramine strengthens the action of galyl or salvarsan, which are the remedies of choice in the beginning.

The fact that intramine is absolutely free from any poisonous action is of very great importance; the same is true for the serum. The serum of a patient under the influence of intramine can be injected into the spinal canal without causing any grave symptoms as they are at times occasioned by salvarsan or galyl.

A man, 34 years of age, with diplopia, had contracted syphilis 5 years previously. He had been treated with mercurial inunctions and injections, then with 9 injections of salvarsan and never had had another sign of syphilis in four years.

He had now a partial paralysis of the oculomotorius with unequal and sluggish pupils; absence of patellar reflex, zone of tactile anæsthesia; loss of flesh very marked, sexual appetite lost for several months.

Three injections of intramine alternating with three of aluvine (oxydase of an aluminium base which is said to have the same action as salvarsan), and after each one of these injections a syringeful of the serum of the patient, collected in 24 hours, was injected into the spinal canal. The cerebrospinal fluid previously examined showed very plainly the characteristic changes of a degenerative myelitis, yet after the fifth injection it had become normal and all subjective symptoms had disappeared. The diplopia was no longer present since the first injection of intramine, which showed plainly that the lesions of the cerebral nerves in degenerative myelitis must be of a meningitic origin at the level of the nuclei of the base.

A physician, 42 years old, had had a chancre on the finger nine months previously. He received in all 17 injections of galyl or salvarsan. In spite of this a large ulcer appeared on the tonsil. The patient had taken mercury, also, but very irregularly. He was given an injection of intramine and in a few

hours the subjective symptoms were quieted, and at the end of 4 days it would have been difficult to find a trace of the ulcer. The general condition was, also, improved.

The introduction into the therapeutic arsenal of a reducing agent like intramine will show its influence not only in syphilis, but, also, in other chronic infections.

A case of lupus (which will be published) treated with intramine gave a decided proof of this action. In chronic blenorrhagia the results are equally good. But we must wait for a longer experience.

Since the advent of salvarsan it must be remarked that the meningeal complications of syphilis have become more frequent, and such cases with a latent character are rapidly transformed into degenerative medullary or cerebral affections by the influence of arsenical preparations. That is why McDonagh has advised to abstain from these energetic treatments when there are no syphilitic manifestations in evidence.

These complications are the more marked and frequent when the treatment has been insufficient; thus, they are observed more often after 2 or 3 salvarsan injections, than after 6 or 8. They will be observed with still less frequency if the salvarsan injections are followed by mercury or iodide. These latter complementary treatments must never be omitted.

How long must this cure be continued without interruptions? This question is not yet settled. We may, however, say that in the primary stage the syphilis should be treated for one year without interruption and for two years in the secondary stage or that of generalization.

The treatment, then, is purely symptomatic.

Should the mercury be administered continually or with intermissions? The best is to administer it in the more active manner, namely, intramuscular or intravenous injections for a more or less prolonged time and in series.

What will be the effect of the introduction of the new remedy with sulphur as a base, intramine, on these known thereapeutic actions in syphilis?

It is not yet possible to exactly determine it. But we can admit that the use of intramine can reduce by half the number of injections of metallic salts and increase their therapeutic effects.

As iodides have shown that they in their turn enhance the effects of intramine we can see what help the physician may

secure by scientific alteration of medicaments. Thus McDonagh often prescribes iodide for about a week before and a week after a big injection of intramine.

In conclusion, here is what he advises: In the first stage of syphilis he prescribes two or three grammes of potassium iodide daily and injects into a vein a big dose of galyl or salvarsan. Three days later he makes an intramuscular injection of 1 or 2 grammes of intramine. About on the seventh day he gives a new big injection of galyl or salvarsan. After this the following treatment can be given for one year: (1) A series of 8 intramuscular injections of gray oil of 0.10 to 0.15 of mercury to fifteen; (2) a series of 8 injections of intramine of from 1 to 3 cc. every fortnight; these injections are alternated with those of gray oil; (3) every three months for one month iodide is to be given internally; the first month of the iodide is to begin after the first 4 doses of mercury and intramine; one month of rest is to follow the series of 8 injections of intramine and mercury (four months and one-half of treatment).

In the secondary stage he first prescribes iodide together with two strong intravenous injections and two intramuscular injections of intramine, as above; then 4 series of the same treatment with mercury and iodide with intramine; and two months after the last injection of this fourth series he gives another maximal intravenous injection, preceded and followed by an intramuscular injection of a big dose of intramine.

In recurring late syphilis he makes first one or two injections of intramine followed by one or two of galyl or salvarsan, then he gives a mixed treatment of mercury, iodide and intramine.

In cases of myelitis or degenerative encephalitis: (1) One injection of intramine; (2) on the fourth day an injection of serum taken from the patient the evening before into the spinal canal; (3) three or four days later a salvarsan injection (not galyl or karsivan which are too toxic); (4) three days later another injection into the spinal canal of serum taken from the patient the night before. These injections are continued alternatingly until the cerebrospinal fluid has become normal.

In congenital syphilis the mixed treatment is to be continued for two years, but the mercury by mouth must be continued longer from time to time.

McDonagh concludes that we have in this new synthetic combination of sulphur, intramine, a very efficient agent in the treatment of syphilis and even of other malignant tuberculous, blennorrhagic, etc., infections.

According to McDonagh the treponema or spirochaete of Schaudinn is from a histochemical standpoint a remarkable composition of a lipoid rich in active hydrogen and of a nucleoprotein rich in active oxygen. The difference which exists between the lipoid protein system of the treponema and the one of the injected patient's serum lies in the great oxyreductory power of the composition of the parasite. The trivalent grouping of the arsenobenzol enters into a combination with it, thus causing its destruction. We deal therefore with purely special chemical affinities and it is no longer necessary to hunt for theories of side-chains, etc., etc., in order to explain the action of salvarsan on the treponema. McDonagh, further, does not believe that arsenic is the only metal gifted with these oxyreducting faculties; he has even found di- and triparaaminobenzene aluminium and a ferro-sulphonate which he called aluvine and ferrivine, the poisonous qualities of which are said to be nil and the oxyreducting action of which is said to be equal to that of the arsenobenzols. The poisonous character of the arsenical compositions makes them so disagreeable in practice.

MEDICAL SOCIETIES.

THE POLYCLINIC OPHTHALMIC SOCIETY.

PHILADELPHIA, PA.

Stated Meeting March 9, 1916.

Dr. Wm. Zentmayer, Chairman.

Subject: "Tuberculosis of the Eye."

Tuberculosis of the Anterior Segment of the Eye.

Dr. Wm. Campbell Posey referred to tubercular conjunctivitis as being rare, and when seen probably due to direct infection. It takes the form of indurated ulcers, most observed in the subtarsal region, usually monocular, and to be distinguished from Parinaud's conjunctivitis by the absence of elongated follicles. The most common form of tuberculosis of the anterior segment is sclerosing keratitis. These cases were formerly thought to be due to gout. Commencing with espiscleral redness and swelling in the palpebral fissure, soon a tongue shaped area pushes its way from the limbus into the interstitial lamellæ of the cornea. Tubercular nodules appear in the cornea as well as the sclera. These may coalesce and the whole cornea become opaque. The disease is essentially chronic and relapsing. It may occasion so much thinning and absorption of the sclera that the uveal pigment shines through. This form is probably due to tubercular toxines, either from tuberculosis elsewhere in the eye, or from tuberculosis of the general system. The cornea may, however, be directly infected following traumatism.

In another form of secondary involvement of the anterior segment from tuberculosis of the posterior part of the eye, mutton fat patches precipitate on the posterior surface of the cornea. This appearance is typical of tuberculosis, also the discrete areas of caseous infiltrate into the interstitial lamellæ of the cornea. Seen most commonly in colored people. Tuberculosis may invade the iris either in the form of solitary or miliary tubercles, the bacilli showing a tendency to involve the vascular parts, the major and minor circles. The typical tubercle is grayish white; later it may assume a yellowish appearance due to the breaking down of the mass. Usually it is also vascular.

Dr. Posey referred to a solitary tubercle of the iris observed by him which attained large size and pressed against the back part of the cornea. For weeks the cornea escaped involvement owing to the protection offered by Descemet's membrane. Later on the interstitial lamellæ of the cornea became involved by the way of the pectinate ligament. When seen early, even large tubercles are amenable to anti-tuberculin treatment.

Tuberculosis of the Posterior Segment of the Eye.

Dr. Luther Peter classified diseases of tuberculous origin as, first, lesions which are due directly to the presence of the tubercle bacillus; second, those which are due to the toxines of tuberculosis; and third, those associated with the general malnutrition and low vitality of which most tubercular patients are victims; this group being in order of most serious consequence to the patient's vision, but in reverse order so far as frequency of occurrence is concerned.

The frequency of ocular tuberculosis has been much disputed. Probably intraocular tuberculosis is quite as frequently found as secondary tuberculosis is observed in other parts of the body.

The first group is practically limited to tubercles of the choroid, retina, optic nerve sheath and tuberculomatous masses, in which the tubercle bacillus has been active. In tubercular meningitis they probably are more frequently found if the fundus examination is carefully and routinely made. It has been stated by Pscher, that tuberculosis of the bronchial glands is a frequent source of tubercles of the choroid. Tubercles of the optic nerve sheath have also been reported.

The second group of intraocular tuberculosis is more frequently observed. In this group are the conditions which are brought about by the toxins which are carried in the blood and lymph streams. Clinically and in order of frequency they are; posterior uveitis with vitreous opacities, periphlebitis or juvenile vascular disease, disseminated choroiditis and neuro-retinitis and papillœdema.

In 320 cases examined by Dr. Peter 314, or all in which a fundus examination could be made, showed a venous engorgement. Veins were tortuous, dark and overdistended. The lower veins were more distended than the upper. Thirty-two showed a neuro-retinitis of low grade; in 17 the retina was hazy; vitreous opacities were present in 7 cases, and unilateral papillœdema was present in one case. The venous engorgement Dr. Peter

believes to be largely mechanical in origin, although toxæmia probably also plays a role in its production. Definite lesions due to the toxins of tuberculosis are more apt to appear in the latent or quiescent tuberculosis, especially when the primary focus is well removed from the eye. If toxæmia plays a role, it is very likely the toxæmia which results from disturbed metabolism, rather than a specific tubercular toxin.

Treatment of Tuberculous Affections of the Eye.

Dr. William Zentmayer said the treatment falls under two heads: general and local. General treatment may be considered more hygienic and medicinal, and the latter more under specific and symptomatic. The hygienic treatment belongs more to the domain of general medicine, at least its consideration will be here omited further than to state that without its features being carried out little can be hoped from other modes of treatment.

Aside from the use of drugs to meet symptoms, such as iron, bichloride of mercury, and cod liver oil, which are remedies of undoubted value as general tonics and nutrients, the specific treatment consists in the use of tuberculin in one of the several forms that are now available. As a rule the ophthalmic surgeons have taken a middle ground between those who stand for large doses and those who follow the method of Wright. von Hippel's method is the one most in use. The dose is increased by this amount at each subsequent administration and this is continued at intervals of from three days to a week until the dose has reached a maximum of 1 mg. or until a reaction is obtained, when the dose just preceding the one which produced the reaction is again given, but not until after an interval of time sufficient for a subsidence of all symptoms. Active treatment should be continued over a period of several months, and after that short courses of tuberculin should be given at six months intervals for several years.

The local treatment of tuberculous eye affections does not differ from that employed in other similar affections. Iodoform ointment and iodin-vasogen seems to have some special value in the management of tuberculous sclero-keratitis.

WALTER W. WATSON,
Secretary.

ABSTRACTS FROM MEDICAL LITERATURE.

By W. F. Hardy, M.D.,
ST. LOUIS, MO.

SUBJECTIVE TESTS FOR ASTIGMATISM, ESPECIALLY ASTIGMATIC CHARTS.

One of the very best, if not the best, recent articles dealing with practical refraction is that of W. B. Lancaster (*Trans. Am. Acad. of Ophth.*, 1915, p. 167). Papers on this subject often receive but scant notice. Lancaster's article will bear reading and then a re-reading. His experimental photographic work goes far to clear up some rather hazy conceptions of the astigmatic chart and the proper method of using it. The author first enters into a discussion of the conoid of Sturm and the focal interval of Sturm. Those of us who use cycloplegics in refraction cannot help but be impressed with Lancaster's subjective test and give his logical reasoning respectful consideration. The classical astigmatic charts were found to possess too great an interval, 30 degrees, between the radiating lines; furthermore three lines in a set were found objectionable because of the frequent monocular diplopia which produces superposition of the lines, giving thereby the impression of a set of lines being as dark or darker than those at a right angle when in reality the reverse is actually the case. This, one can demonstrate frequently with one's own eye, and the camera furnishes indubitable proof of this phænomenon. Lancaster has devised a chart made of extremely white paper, wedding stock, with radiating lines made of black velvet baby ribbon. The radii are 10 degrees apart, 20 cm. long, with a clear space in the center of 10 cm. in diameter. This chart is for the purpose of selecting the axis of the cylinder found to be needed. The second chart, made of the same materials, consists of a cross made of two of the pieces of velvet ribbon crossing at right angles; this can be rotated to the required axis. The author goes at length into the use of the charts. Several precautions must be observed. Partial closure of the lids forming a stenopaic opening must be prevented. A patient can and frequently does neutralize his astigmatism by his accommodation. This Lancaster says is the rule. The camera again furnishes the clew to the explanation. The part of the focal interval which

falls on the retina (the ciliary muscle accommodating) or photographic plate (by adjusting the screw) is the interfocal circle which does not blur one line more than another, and so the lines look all alike. "The eye shifts the focal interval forward or back by accommodating and relaxing so as if possible to get that part on the retina which will give the best image." Some authorities say the eye prefers a focal line on the retina, especially the vertical focal line; others state the focal circle is the choice. Reymond contended that the eye shifts rapidly forward and back from one focal line to the other. This latter view is unsupported. Lancaster thinks that with high astigmatism the patient prefers the focal line; with low astigmatism he prefers the focal circle.

To obviate the disturbing effect of the accommodation the following point must be emphasized or the subjective testing is a failure, viz.: that the whole of the focal interval must be kept in front of the retina. In hyperopia it is all wrong to work up with plus spheres and plus cylinders. Keep the whole focal interval in front of the retina with convex spheres and work down with minus cylinders and when the astigmatism is corrected then to better improve vision work down with weak minus spheres.

The paper of Lancaster is too long and meaty to be briefly abstracted and yet do it complete justice. It may be well to quote the closing paragraphs. "Let us measure our patients with as great precision as possible and spare no pains; but let us be honest with ourselves and not suppose we are more accurate than we really are, or that whoever differs from us is wrong, or that by using a cycloplegic all error will be eliminated. Astigmatic charts excel where the astigmatism is of low degree with good visual acuity in intelligent patients—just the most common and important type of patient in private practice. No other test is nearly as accurate in cases of this class. Precisely the class of patients where a small departure from the best correction produces most trouble.

"In patients of poor powers of observation or with high astigmatism or poor visual acuity other tests excel, especially skiascopy. Incidentally the proper method of applying the test leads to an unmasking of considerable hypermetropia which might otherwise remain latent."

The reviewer has read the article in full five times, each time with unabated interest; is an advocate of cycloplegic refraction, but finds daily use for Lancaster's charts and methods, and is

glad to say that in errors of low degree with observant patients it is superior to skiascopy. Also it is a splendid post-cycloplegic method.

COMPLETE VOCATIONAL DISABILITY FROM MUSCULAR IMBALANCE OF THE EYES.

Lloyd Mills has an article with the above title in the *Journal A. M. A.*, September 2, 1916, which is intended primarily for the general practitioner. The main object of his paper is, as he states, to impress the necessity for early recognition of muscular imbalance. He inclines to the belief that two of the most serious eye conditions with which we have to deal, viz.: cataract and glaucoma, are in a way the result of overwork of the ocular muscles. This applies particularly to hyperopic eyes. Mills states that the lack of early and constant correction of the refractive error, which causes the uninterrupted overwork of the ocular muscles, leads to early sclerosis of the lens and to early fibrosis of the filtering or pressure equalizing apparatus of the eyes and thus to cataract or glaucoma respectively. He truly states that few physicians realize the importance of the accurate fitting and adjustment of glasses. (It is a daily occurrence that we are met with the semi-apologetic statement of a patient that "he just came to have his eyes fitted with glasses." It is remarkable also the number of presumably intelligent physicians who actually refer patients to an optician or so-called optometrist. Many of the laity and some few of the medical profession do not seem to appreciate the distinction between an optician and oculist.) Mills calls particular attention to the train of oftentimes obscured symptoms resulting from vertical deviations. The statement is made that those who develop headache while motoring, shopping, at moving pictures, those who become trainsick and to a certain extent those who are most susceptible to seasickness, practically always show relative overaction of the adducting muscles. Mills in common with others has found ocular trouble frequently associated with intranasal disease and has found a restoration to a normal balance much simpler after relief of the nasal condition. He classes the imbalance in these cases as irritative, in contrast to the form of imbalance so frequently associated with chronic nasal disease, but characterized by relatively feeble adductive power, which latter he holds to be a toxic pseudoparalytic stage of the same disorder.

The lack of sufficient adducting power prevents close work being done with comfort and is the predominant condition in that large class of patients whose vocations demand concentration on work close at hand. Some of the patients have to abandon their calling if uncorrceted or improperly corrected. Many of the cases have passed through the hands of one or more physicians without, as Mills says, reflecting much if any credit on the profession as a whole.

A discussion of muscular imbalance and refractive errors is dry and uninteresting reading for the average practitioner, but it is only by educating them up to the possibilities of relief afforded by proper refraction, that oversight and indifference will be overcome.

THE NON-OPERATIVE TREATMENT OF STRABISMUS.

At the Philadelphia meeting of the Medical Society of the State of Pennsylvania (*Penn. Med. Jour.*, May, 1916) two papers appeared dealing with squint. one by Hansell touching upon the operative side of the subject, and one by Reber with reference to the non-operative treatment. In some respects these authors hold diverse views. Hansell has little regard for bandaging the good eye whereas Reber holds it in favor, though not to the exclusion of other methods. Reber's opening statement, that the treatment of strabismus in its early stages, whether of the convergent, divergent, or vertical phase, is almost invariably non-operative, is unquestionably true. The two factors predisposing to strabismus are (a) a central defect, some degree of arrest or embarrassment in the fusion faculty, plus (b) a peripheral defect, represented by a refraction error that only serves to aggravate the innervational disturbances already present. Other factors are anatomical anomalies, generally congenital, medical opacities and central choroidoretinal lesions. The two prime measures in non-operative treatment are an initial correction of the refractive error and a final cultivation of binocular single vision. In children under nine there are four things of importance in handling strabismus: (1) visual acuity; (2) degree of deviation; (3) the refractive status, and (4) the status of the fusion faculty. These points were taken up separately by Reber. A vision of 5/20 or less is considered an amblyopic eye. The different methods of measuring the deviation,

all approximate, are given. In determining the refraction Reber stands out strongly for atropia and retinoscopy, working at 20 inches and holding the lenses in the hand before the eye. He feels that after accurate refraction the real treatment has just begun. Accommodation is prevented for three months by the daily morning use of a drop of 1/240 atropia solution in each eye. In addition to this, invisible bifocals, after the suggestion of Linn Emerson, are ordered. A plus 3.00 sphere added to the distance correction is worn in the lower segment for a year, thus keeping the accommodation completely at rest. The next year this is reduced to plus 2.00 sph., after another year to plus 1.00 sph., and finally in another year the distance correction only is worn. After correction with glasses, fusion training is advised and the different methods and instruments used are given. It is admitted that this is a difficult, painstaking and patience consuming procedure. As to the use of a binder over the good eye, Reber gives his approval. It and atropinization of the good eye is good practice. After two years of age the binder is used at mealtime when the child can be watched. In conclusion Reber states: "It must be urged that the non-operative treatment of strabismus when successful achieves a perfectness and beauty of result seldom accomplished with the scissors (that is, straight eye with full binocular vision), while, even if it fails of this ideal result, it furnishes the ideal preparation for operation in that it reduces the amount of operative work that may be necessary in any case and offers to the surgeon greater certainty and hope of a favorable operative result, if such becomes necessary."

THE OPERATIVE TREATMENT OF STRABISMUS.

Hansell (*Penn. Med. Jour.*, May, 1916) in a brief, terse article discusses the operative treatment of squint. Before contemplating operation it is assumed all other measures have been tried and found wanting. The dangers and elements making for failure must be well considered. The different measures for esophoria and esotropia are considered. Esophoria cannot exist in the presence of monocular amblyopia. Operation in esophoria is advised if asthenopia persists beyond the cure by medicinal and optical measures. Double tenotomy is chosen, resting when an over-effect of two to four degrees is obtained. Both tenotomies should be done at the same sitting. Advancement is not recommended. The degree of esophoria calling for operation is

not fixed, varying with the individual. In esotropia the conditions are different. Tenotomy is not the operation to be chosen. The passing of a phoria into a tropia is not because of increased strength of the converging muscles but of a weakening of the diverging muscles. Double advancement here gives the best results provided a primary divergence of ten to fifteen degrees is secured and both eyes are bandaged for at least three days. The surgeon's experience is the safest guide in determining the amount of shortening required. No rule of thumb, so many degrees per millimeter, is dependable. The upward deviation, always present in the squinting eye and transferable with the internal squint, may be safely disregarded in the operation. The prognosis of advancement operations performed to rectify excessive convergence when the refraction and vision of the two eyes are approximately equal, is most favorable. Diplopia may be disregarded, as binocular single vision is soon obtained. Provided the squint remains concomitant the age of the patient is unimportant. The patient should wear full correction. A tendency to fix with one eye or the development of a monocular squint is a positive indication for operation. In monocular squint the amblyopia in the squinting eye is congenital. Hansell places little reliance in efforts to improve the vision of the amblyopic eye by exclusion of the good eye, bandaging, etc. He states it raises false hopes, is time consuming and burdensome. That it raises visual acuity is certain, but as soon as the eye is unbandaged and the use of the good eye resumed the amblyopic eye does not participate except to see objects on that side of the field. Operation is only cosmetic. Binocular vision is not obtained because of the difference in visual acuity and absence of the power of fusion. The method of operation depends on the degree of squint. High degrees require double advancement with a combined tenotomy of the internus of the squinting eye; moderate degrees, single advancement and tenotomy of the squinting eye. Tenotomy is not extensive, being limited to a severance of the scleral attachment. Vertical deviation accompanying the strabismus may be ignored. The principles outlined for internal squint are applicable for divergent strabismus. With certain exceptions, divergence results from weakening or loss of converging power. The externi are only relatively strong. Most functional cases are found in myopes and persons tenotomized for internal strabismus. Monocular amblyopia is not a cause of primary divergent squint, though opacity of the media is a common

cause. Tenotomy of the externi is not a dependable procedure though of temporary benefit. Hansell disagrees with Valk, who claims that virtually all cases may be cured. Failures are frequent enough. The operations and failures would be fewer were we able, before operating, to restore the function to the cerebral centers and the efferent nerves.

HYPERPHORIA AND ITS TREATMENT.

From a reading of the text it would appear that the title of the paper by Blair (*Penn. Med. Jour.*, June, 1916) is incorrectly chosen. Presumably heterophoria is meant. Refraction forms a large part of the ophthalmologist's practice and problems in heterophoria are constantly coming up. As the figures show, true orthophoria is the exception rather than the rule. To determine whether symptoms are the result of imbalance or the concomitant refractive error is at times very difficult. Binocular single vision is often gained only at the expense of great nervous energy. Blair tabulates his results in an investigation of one thousand cases. They are given in percentages with regard to the existing refractive error. The totals only are here given; exophoria 33 per cent., esophoria 44 per cent., right hyperphoria 15 per cent., left hyperphoria 24 per cent., orthophoria 10 per cent. Esophoria was found in a large number of myopes (47 per cent.) and exophoria in hyperopia (31 per cent.). The large per centage of left hyperphoria (24 per cent.) as compared with right hyperphoria (15 per cent), is to be noted. Heterophoria present two distinct phases; first there is the want of balance due to a purely physical state the result of size or location of attachment of a muscle compared with its antagonist; second, there is what may be termed the psychological basis, meaning by this the control of the muscle balance residing in the lower brain centers and independent of the will. Some authorities place the anomaly of faculty muscle balance wholly upon a physical basis whereas others unduly emphasize the psychological element. Blair thinks the true explanation is the one which includes both the physical and psychological elements as causative factors. No attempt was made in Blair's study to show the values of the duction power. Mention, however, is made of the methods of measuring it. Some begin with weak prisms and gradually increase until the limit of duction power is reached

(the stepping up process). Others start with a strong prism and gradually reduce until the prism is reached that can be overcome. Blair modifies this by going up and down, covering the debatable portions of the scale several times and eventually finds that the limit will be found the same when reached by ascending as by descending the scale. Treatment depends on many factors. Does the physical or psychological element prevail? The first thing to be done is a careful correction of the refractive error. Exophoria with hyperopia calls for different treatment than hyperopia with esophoria. The same is true of myopia with esophoria or exophoria. Blair inclines to the use of the stereoscope in training instead of the amblyoscope of Worth. Exercises are of value only in increasing the strength of the interni (in exophoria), and of little or no value in increasing the strength of the externi (in esophoria) or in vertical phorias. For the latter prisms are ordered for constant use. This is in accord with settled custom of most observers. Little benefit has been gained by the use of the galvanic current. In general the use of prisms is condemned. Operative measures are to be held in abeyance as a method of last resort. No operation in ophthalmic surgery, says the author, is so disappointing in its end results as the tenotomy, or advancement operation for latent squint or heterophoria. Blair advises that operative measures be confined to the lateral muscles and never done on the vertical ones. In correcting the refractive error we have not done all that is possible for the relief of asthenopic symptoms.

BOOK REVIEWS.

THE OPHTHALMIC YEAR BOOK. Volume XII, containing a digest of the literature of ophthalmology for the year 1915. Edited by Edward Jackson, M.D., L.D., assisted by a large number of collaborators. Illustrated. Herrick Book & Stationery Co., Denver, Col.

The usefulness of such a book of reference is well appreciated by every one engaged in scientific work. but it is of the same or even greater value to the practitioner, because it saves him the reading of an overgrown literature and because of the careful and judicious selection of the articles embodied in it. The latter is warranted by the Editor and his well-known body of collaborators. The present volume is of the same high character as were its predecessors. No oculist should be without it.

THE AMERICAN ENCYCLOPEDIA AND DICTIONARY OF OPHTHALMOLOGY. Edited by Casey A. Wood, M.D., C.M., D.C.L. Assisted by a large staff of collaborators. Fully illustrated. Volume IX. "Institutions for the Blind" to "Lemotes." Chicago, Cleveland Press, 1916.

In the beginning of this volume the very complete and beautifully illustrated article on Institutions for the Blind is finished. Among the mass of smaller articles there are some very interesting ones on the iris, iritis, operations on the iris, keratitis and operations on the cornea. Lacrimal affections and the legal relations of ophthalmology take up a very considerable space. Last, not least this volume again contains excellent biographies of a great many oculists, among them our own H. Knapp. Altogether this volume is a fitting mate of the preceding ones.

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